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(30)Priority

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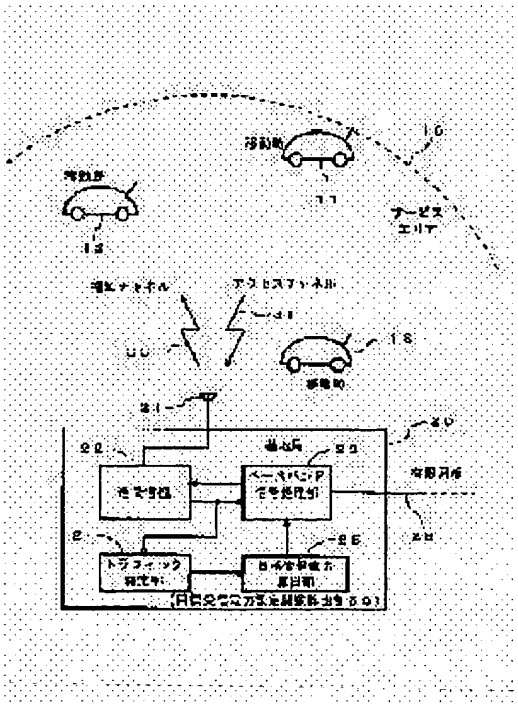
(54) MOBILE COMMUNICATION SYSTEM, BASE STATION DEVICE, MOBILE STATION DEVICE AND TRANSMISSION POWER CONTROLLING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To make a system capacity large and also to avoid sharp gradation of system performance at high traffic by calculating the target receiving power value of a signal received by a base station, based on traffic quantity and allowing a mobile station to calculate a transmission power value with the target receiving power value as a reference.

SOLUTION: A base station 20 receives a signal of an access channel 31 which is transmitted by mobile stations 11 to 13 and a transmitter-receiver 22 demodulates it. A traffic measuring part 24 measures traffic quantity and outputs it as traffic information. A target receiving power information calculating part 25 calculates a target receiving power value from the traffic information. A baseband signal processing part 23 stores attribute information of mobile stations and target receiving power information corresponding to it in a prescribed block of informative channel information and the transmitter-receiver 22 transmits the signal to the



stations 11 to 13 through an informative channel 30. The stations 11 to 13 calculate transmission power of a transmission packet from the target receiving power information and receiving power of the channel 30.

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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the mobile communication system which carries out random access of the packet communication between two or more mobile stations and a base station with a CDMA (code division multiple access) method especially using a common channel, base station equipment, mobile station equipment, and the transmitted power control method about mobile communication system, base station equipment, mobile station equipment, and the transmitted power control method.
[0002]
[Description of the Prior Art] In the communication in the going-up circuit from the mobile station of the mobile communication system which used the CDMA (code division multiple access) method for the point-to-multipoint connection method to a base station, the performance degradation (the so-called far and near problem) which happens since the received power in the base station of the signal from each mobile station changes with differences in the distance between base station-mobile stations poses a big problem. In order to mitigate this far and near problem, transmitted power control which generally controls the transmitted power at the time of mobile station transmission by mobile communication system using the CDMA method so that the received power in the base station of the signal from each mobile station becomes equal is performed.
[0003] On the other hand, in a radio packet transmission system, the method which does not perform channel control which is vacant like a cellular-phone system at the time of call origination, and assigns a channel, for example, transmits a data packet immediately by the same channel like a slot aloha shirt method synchronizing with a slot is used. In this case, although many signals may collide, it is known for the system which adopted the point-to-multipoint connection method (FDMA, TDMA method) of a narrow-band system that it is effective in packet reception being attained under the conditions set in the collision state according to the received-power difference in the base station of the signal from each mobile station (the so-called capture effect).
[0004]
[Problem(s) to be Solved by the Invention] the effect of transmitted power control of a system perform packet transmission using a CDMA method -- "effect of the transmitted power control in move packet CDMA communication" 1996 Institute of Electronics and Communication Engineers synthesis convention lecture collected works It is indicated by p.374 communication [1] and March, 1996. If transmitted power control is introduced in the system which performs packet transmission of a slot aloha shirt method using a CDMA method according to this reference, although system capacity (the maximum point of a throughput) will become large, when traffic becomes high and exceeds the maximum point of a throughput, there is a fault that system performance deteriorates rapidly.
[0005] Although all the input-signal power in a base station becomes equal since transmitted power control is performed, if traffic increases, since the number of signals multiplexed by the same frequency band will increase and all the signals of an other station will serve as noise power, this is because it

becomes below the level that can receive the SN ratio of the input signal of all mobile stations.
[0006] Moreover, although degradation of the rapid system performance in a high traffic state is not seen since the capture effect is acquired when transmitted power control is not performed in the packet transmission system using the CDMA method, the fault that system capacity (the maximum point of a throughput) is small as compared with the time of transmitted power control exists. Furthermore, the received power in a base station becomes large, so that the distance between base station-mobile stations is near since the transmitted power of the packet in a mobile station is fixed when transmitted power control is not performed. For this reason, the fault that it is large as compared with the receiving probability of a mobile station with the far receiving probability of the transmitting packet of the mobile station near a base station, and communicative unfair nature exists according to the geographical conditions of a mobile station also exists.
[0007] this invention aims at offering the mobile communication system and the transmitted power control method of being made in order to solve the above-mentioned trouble, and being able to enlarge system capacity (the maximum point of a throughput), avoiding degradation of the rapid system performance at the time of high traffic, and easing the unfair nature of communication by the geographical conditions of a mobile station.
[0008]
[Means for Solving the Problem] this invention consists of two or more mobile stations which exist in the communication region of a base station and a base station, in order to attain the above-mentioned purpose. In the mobile communication system which communicates by the radio channel of the same frequency band between the aforementioned base station and the aforementioned mobile station in the communication region concerned A traffic-measuring means to measure the amount of traffic of a radio channel, Based on the amount of traffic concerning a radio channel, it has a transmitting means to transmit a signal with the transmitted power found on the basis of the target received-power value which agreed with a target received-power calculation means to compute the target received-power value in a base station, for the self attribute.
[0009] In this invention, when system capacity is made to increase and the traffic of a radio channel increases by performing control equivalent to the usual transmitted power control when there is little traffic of a radio channel, based on the attribute of each mobile station, a difference can be prepared in the target received-power value in a base station, and the probability that transmission will be successful with the capture effect can be raised.
[0010]
[Embodiments of the Invention] Hereafter, the example of this invention is explained using a drawing. Drawing 1 is the block diagram showing the system unit composition of the 1st operation gestalt of this invention. In drawing 1 , when two or more mobile stations 11, 12, and 13 in a service area 10 communicate with other terminals which are not illustrated through a base station 20 and a wire circuit 26, using the common access channel 31, each mobile stations 11, 12, and 13 are arbitrary timing, or transmit a packet to a base station 20 synchronizing with a predetermined slot. In addition, four or more mobile stations may exist. Moreover, a method which it may be assigned to the mobile station fixed, for example, and a mobile station chooses at random about allocation of the diffusion sign in a CDMA method from the signs which can receive a base station may be used.
[0011] It will get over with a transmitter-receiver 22, and a base station 20 will output receiving baseband signaling to the baseband signal-processing section 23 and the traffic-measuring section 24, if an antenna 21 receives the signal of the access channel 31 which mobile stations 11, 12, and 13 transmit. In the traffic-measuring section 24, the number of effective receive packets around unit time is measured as an amount of traffic, for example. The traffic-measuring section 24 is outputted to the target received-power information calculation section 25 by making a measurement result into traffic information. The target received-power information calculation section 25 computes a target received-power value from traffic information. The target received-power information which the target received-power information calculation section 25 computes consists of two or more different values for every attribute of a mobile station.

[0012] Drawing 2 is explanatory drawing showing an example of the content of the table used in case a target received-power value is calculated from the number of effective receive packets. Drawing 2 is a table at the time of defining three kinds of mobile station attributes. The table of drawing 2 can consider storing in the memory for example, in the target received-power information calculation section 25. The target received-power information calculation section 25 calculates the target received-power value corresponding to the traffic information which the traffic-measuring section 24 measured using the table shown in drawing 2 , and outputs it to the baseband processing section 23.
[0013] The target received-power information calculation section 25 is [as opposed to / an attribute 1 / as target received-power information / when the amount THm of traffic which the traffic-measuring section 24 measured now is TH1 < THm < TH2] POW21 from the table of drawing 2 . It is POW22 to an attribute 2. POW23 is calculated from an attribute 3. These target received-power information searched for in the target received-power information calculation section 25 is outputted to the baseband processing section 23.
[0014] although the concrete example of an attribute and target received-power information is mentioned later -- an attribute -- or [for example, / having been measured] -- or it may be the distance from the presumed base station, and when traffic is small, each target received-power information does not have a difference by the difference in an attribute, or is small, and a difference may be expanded, so that traffic becomes large
[0015] The baseband processing section 23 which received target received-power information stores the attribute information on a mobile station, and the target received-power information corresponding to it in the predetermined block of information channel information, and outputs them to a transmitter-receiver 22. A transmitter-receiver 22 transmits a signal including the attribute information on a mobile station, and the target received-power information corresponding to it to mobile stations 11, 12, and 13 through the information channel 30.
[0016] The target received-power information calculation section 25 may calculate a target received-power value by calculation instead of using a table like drawing 2 . In this case, the rule which calculates a target received-power value from traffic information is decided. for example, the difference between the mobile station attributes of the target received-power value POW1 corresponding to the mobile station of an attribute 1 (attribute of the highest priority), and a target received-power value -- the initial value of deltaPOW, and difference -- the rule to which deltaPOW is changed is decided and the target received-power value of each mobile station attribute is calculated for example, the difference in Time t -- deltaPOW (t) is defined as follows
[0017]
[Equation 1]

$$S(t) = \begin{cases} (-1) \times S(t-1) & : \text{THmが前回より減少した時} \\ S(t-1) & : \text{その他の時} \end{cases}$$

（ 但し、$S(0) = 1$ ）

$$\Delta POW(t) = \Delta POW(t-1) \times \alpha^{S(t)}$$

（αは定数：例えば、$\alpha = 1.1$）

[0018] And the target received-power value POWi of each attribute in Time t (t) is calculated by the following formulas.
[0019]
[Equation 2]

$$POW_i(t) = POW_1 - (i-1) \times \Delta POW(t)$$

[0020] This example calculates the amount of traffic based on the number of effective packets which the traffic-measuring section received to per unit time in the base station, and a target received-power calculation means computes target received power by setting up the difference between the calculation

values of the target received power corresponding to the aforementioned attribute in adaptation so that the amount of traffic measured with the aforementioned traffic-measuring means may serve as the maximum.

[0021] Drawing 3 is the flow view showing the flow of the mobile stations 11, 12, and 13 in this operation form of operation. Mobile stations 11, 12, and 13 are in an idle state (S10) in a normal state. If information information is received from a base station 20 in this state, the target received-power information which agreed for the self attribute out of the target received-power information which discards the old target received-power information memorized until now, and exists in the received information information will be chosen, and it will newly memorize as target received-power information (S14), and will return to an idle state S10 again. If the packet which should transmit occurs, mobile stations 11, 12, and 13 will shift to S11, and will compute the transmitted power of a transmitting packet from the target received-power information memorized in a mobile station, and the received power of the information channel 30 (S11). Next, the signal of a transmitting packet is sent out to the access channel 31 with the transmitted power computed by S11 (S12), and it shifts to the response waiting state S13.

[0022] When the information information from a base station 20 is received in the response waiting state S13, target received-power information is updated like an idle state S10 (S15). It ends by generally receiving the confirmation-of-receipt (ACK) signal from a base station 20, and transmitting processing of a packet returns to an idle state (S10) again in this case. When an ACK signal is unreceivable within fixed time, it returns to S11 again and resending processing of a packet is performed.

[0023] When it considers as the received power in the mobile stations 11, 12, and 13 of the signal (for example, signal of the information channel 30) transmitted from the base station 20 while connecting the attribute of mobile stations 11, 12, and 13, for example, when mobile stations 11, 12, and 13 receive information information, measurement of the received power of the information channel 30 is performed simultaneously. Operation (S14, S15) of renewal of target received power is performed for the measured received-power value as attribute information on self.

[0024] In considering as the distance from the base station 20 while connecting the attribute of mobile stations 11, 12, and 13, it carries positioning systems, such as GPS, in a mobile station as for example, a range-measurement means. And the distance between base station-mobile stations is computed within a mobile station by broadcasting the positional information of a base station 20 by the information channel 30. Mobile stations 11, 12, and 13 perform operation of renewal of target received power for the distance between the base station-mobile stations computed by doing in this way as attribute information on self.

[0025] Drawing 4 is a graph which shows change of the transmitted power of the mobile station by the distance at the time of performing the usual transmitted power control. It is not concerned with distance from a base station, but the transmitted power of each mobile station is controlled so that the signal of arbitrary mobile stations is altogether received on the same level in a base station. Distance information actually computes distance using a positioning system, or measures the received power of the information channel from a base station, and presumes it from this value. That is, transmitted power is enlarged when the received power of an information channel is small. Therefore, transmitted power becomes large, so that it goes around a cell, and the disturbance done to a contiguity cell becomes large.

[0026] Drawing 5 is a graph which shows transmitted power control when the amount of traffic in this invention is big. In this case, a target received-power value which divides a mobile station into three attributes according to distance, and illustrates it corresponding to each attribute, for example is assigned. That is, to a base station, on the basis of the mobile station of the attribute 1 of a short distance, only delta POW assigns low power and assigns [as opposed to / the mobile station of the middle-distance attribute 2] power only with low 2xdelta POW as opposed to the mobile station of the further long-distance attribute 3. Let assigned power be a value between the power at the time of not performing transmitted power control with the power at the time of performing the usual transmitted power control.

[0027] A big difference arises in the received power in a base station, and the success percentage of

packet transmission improves compared with the conventional transmitted power control according to the capture effect, so that for example, the amount of traffic is large by performing such transmitted power control. Moreover, in the periphery of a cell, the transmitted power of a mobile station becomes small rather than the case where the usual transmitted power control is performed, and the disturbance done to a contiguity cell becomes small.

[0028] Drawing 6 is the block diagram showing the composition of the base station in the 2nd operation form of this invention. It sets to drawing 6 . The same sign as drawing 1 is given to the same composition as drawing 1 . With this operation form, a base station 40 reports traffic information, and a mobile station computes target received power by receiving this traffic information. For this reason, as compared with the base station 20 of drawing 1 , the base station 40 of drawing 6 does not have the target received-power calculation section. In the base station 40 of the 2nd operation form, the baseband processing section 23 receives the traffic information measured in the traffic-measuring section 24, traffic information is stored in the predetermined block of information channel information, and it outputs to a transmitter-receiver 22. A transmitter-receiver 22 transmits a signal including traffic information to a mobile station through the information channel 30.

[0029] The mobile station stores beforehand in the memory in a mobile station the same table as the table shown in drawing 2 . And reception of the information information from a base station 40 computes the target received-power information of self using the table of drawing 2 based on the traffic information and the attribute information on self which exist in the received information information. Then, the old target received-power information memorized until now is discarded, and it memorizes in a mobile station by making the newly computed value into target received-power information.

[0030] Operation of a mobile station is the same as that of the flow of operation shown in drawing 3 from traffic information and a table except the point which computes target received-power information at the time of renewal of target received power. Moreover, the method of deciding the rule which calculates a target received-power value from the traffic information explained with the form 1 of operation as a method of computing target received-power information with a mobile station may be used.

[0031] Next, the 3rd operation gestalt of this invention is explained. With this operation gestalt, a base station 20 computes a target received-power setting function based on traffic information. And the parameter which specifies a target received-power setting function is transmitted to a mobile station through the information channel 30. A mobile station reconfigurates a target received-power setting function from the received parameter information, and determines a target received-power value from this target received-power setting function based on the attribute of a local station.

[0032] Since composition and operation are similar with the 1st embodiment the 3rd operative condition, it explains focusing on difference. [like] In the 3rd embodiment, the target received-power setting function calculation section 50 is formed instead of the target received-power information calculation section 25 in the base station 20 of drawing 1 . The target received-power setting function calculation section 50 computes a target received-power setting function from traffic information. The target received-power setting function which the target received-power setting function calculation section 50 computes is a function which sets a horizontal axis a vertical axis as the attribute value of a mobile station as a target received-power value.

[0033] Drawing 7 is explanatory drawing showing an example of a target received-power setting function. The target received-power setting function shown in drawing 7 takes the target received-power value POW0 with a certain fixed attribute value (point of inflection : Rip), and it expresses with the linear function which changes by inclination a with a fixed target received-power value after it. The target received-power setting function calculation section 50 determines point of inflection Rip and inclination a with the parameter which specifies such a target received-power setting function, for example, the target received-power setting function of drawing 7 , using traffic information.

[0034] Drawing 8 is a table used in case it asks for the point of inflection Rip and inclination a which are the parameter information on a target received-power setting function. The table of drawing 8 can consider storing in the memory for example, in the target received-power setting function calculation

section 50. The target received-power setting function calculation section 50 asks for the point of inflection Rip and inclination a corresponding to the traffic information which the traffic-measuring section 24 measured using the table shown in drawing 8 , and outputs them to the baseband processing section 23.

[0035] When the amount THm of traffic which the traffic-measuring section 24 measured now is TH1 < THm < TH2, from the table of drawing 8 , as parameter information on a target received-power setting function, the target received-power setting function calculation section 50 asks for point of inflection with Rip2, and asks for an inclination with a2. These parameter information searched for in the target received-power setting function calculation section 50 is outputted to the baseband processing section 23. It may be set up so that parameter information does not have it when the difference by the difference in the attribute value in target received power has the small amount of traffic, or it is small, and it may be so small that the amount of traffic becomes large so that the amount of traffic becomes large and a difference may be expanded namely, and inclination a may become large. [of point of inflection Rip]

[0036] The baseband processing section 23 which received the parameter information on a target received-power setting function stores parameter information in the predetermined block of information channel information, and outputs it to a transmitter-receiver 22. A transmitter-receiver 22 transmits a signal including parameter information to mobile stations 11, 12, and 13 through the information channel 30. The target received-power setting function calculation section 50 may search for the parameter information on a target received-power setting function by calculation instead of using a table like drawing 8 . In this case, the rule which searches for parameter information from traffic information is decided. For example, point of inflection Rip is made into constant value, and inclination a is changed using traffic information. In addition, as a value of point of inflection Rip, it is good also as 1/2 of the radius of the service area of a base station, for example. The target received-power setting function y in Time t (x t) is decided like the following formulas.

[0037]

[Equation 3]

$$y(x,t)=\begin{cases} POW0 & : \ x < Rip \\ a(t) * x + (POW0 - Rip * a(t)) & : \ その他 \end{cases}$$

[0038] And inclination [in Time t] a (t) is defined as follows.

[0039]

[Equation 4]

$$S(t)=\begin{cases} (-1)\times S(t-1) & : \ THmが前回より減少した時 \\ S(t-1) & : \ その他の時 \end{cases}$$

(但し、S(0)＝1)

$$a(t) = a(t-1)\times \alpha^{S(t)}$$

(αは定数：例えば、α＝1.1)

[0040] The aforementioned target received-power setting function is computed by setting up the inclination of a target received-power setting function in adaptation so that the amount of traffic in which was asked for the amount of traffic and the target received-power setting function calculation means measured it with the traffic-measuring means may serve as the maximum based on the number of effective packets to which the traffic-measuring section received this example to per unit time in the base station.

[0041] Next, operation of the mobile station in the 3rd embodiment is described. In the flow view of the 1st embodiment which showed operation of a mobile station to drawing 3 , it is only that the contents of processing of S14, or S15 and S11 differ, and other processings are the same. If information information is received from a base station 20, in S14 or S15, a mobile station will newly memorize the parameter

information which discards the parameter information on the old target received-power setting function memorized until now, and exists in the received information information as parameter information, and will return to an idle state S10 or the response waiting state S13 again.
[0042] If the packet which should transmit occurs, a mobile station will shift to S11, will reconfigurate a target received-power setting function from the parameter information memorized in a mobile station, and will compute the target received-power value corresponding to the attribute value of a local station. The contents of processing of other steps are the same as the 1st embodiment mentioned above.
[0043] As mentioned above, although the example was indicated, a modification which is described further below is also considered. Although the example which measures the amount of traffic in a base station as an example was indicated, this invention can also be carried out only by the processing by the side of a mobile station by measuring the amount of traffic in a mobile station. For example, you may presume the amount of traffic with the rate of failure of packet transmission. That is, it is regarded as what has many amounts of traffic, so that there is much number of times of resending of a packet, and according to the number of times of resending of a packet, it may be made to enlarge the power difference by attribute value.
[0044] The example which adopts the received power of the information channel corresponding to the measured distance or this distance from a base station mostly as an attribute is indicated, and although it decreases rather than the case where the disturbance done to the adjoining cell performs transmitted power control equally in the case of this example, there is a trouble that the mobile station near a base station will be advantageous. In order to solve this, a mobile station is divided into two or more groups at random, and a different attribute for every group is assigned. And this assignment is changed one by one a fixed period. If it does in this way, a priority changes periodically, and it will become equal if it averages. Moreover, you may make it in the case of emergency intelligence etc., correct the attribute of a terminal according to the attribute of data so that a target received-power value may become large.
[0045] Although the amount of traffic to measure indicated the example which is the number of effective receive packets for every predetermined time, when traffic increases extremely, reception of a packet becomes impossible, and it also has a possibility that the number of effective receive packets may decrease on the contrary. Then, you may make it presume the amount of traffic from the total received power in a base station.
[0046]
[Effect of the Invention] If according to the mobile communication system and the transmitted power control system of this invention target received power is not depended on the attribute of a mobile station, but it fixes and the amount of traffic becomes large when the amount of traffic is small as explained above, the target received power which changes with attributes of a mobile station will be set up, and packet transmission will be performed by the target received power with which the mobile station agreed for the self attribute. Therefore, since the attribute of a mobile station becomes possible [suppressing the transmitted power of the large mobile station of transmitted power in the state of high traffic] in the case of the received power of the electric wave which a base station emits, or the distance between mobile station-connection base stations which measured, the interference power to other cells is mitigated and it is effective in becoming possible to avoid rapid degradation of system performance according to the capture effect.

[Translation done.]

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TECHNICAL FIELD

[The technical field to which invention belongs] This invention relates to the mobile communication system which carries out random access of the packet communication between two or more mobile stations and a base station with a CDMA (code division multiple access) method especially using a common channel, base station equipment, mobile station equipment, and the transmitted power control method about mobile communication system, base station equipment, mobile station equipment, and the transmitted power control method.

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PRIOR ART

[Description of the Prior Art] In the communication in the going-up circuit from the mobile station of the mobile communication system which used the CDMA (code division multiple access) method for the point-to-multipoint connection method to a base station, the performance degradation (the so-called far and near problem) which happens since the received power in the base station of the signal from each mobile station changes with differences in the distance between base station-mobile stations poses a big problem. In order to mitigate this far and near problem, transmitted power control which generally controls the transmitted power at the time of mobile station transmission by mobile communication system using the CDMA method so that the received power in the base station of the signal from each mobile station becomes equal is performed.

[0003] On the other hand, in a radio packet transmission system, the method which does not perform channel control which is vacant like a cellular-phone system at the time of call origination, and assigns a channel, for example, transmits a data packet immediately by the same channel like a slot aloha shirt method synchronizing with a slot is used. In this case, although many signals may collide, it is known for the system which adopted the point-to-multipoint connection method (FDMA, TDMA method) of a narrow-band system that it is effective in packet reception being attained under the conditions set in the collision state according to the received-power difference in the base station of the signal from each mobile station (the so-called capture effect).

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EFFECT OF THE INVENTION

[Effect of the Invention] If according to the mobile communication system and the transmitted power control system of this invention target received power is not depended on the attribute of a mobile station, but it fixes and the amount of traffic becomes large when the amount of traffic is small as explained above, the target received power which changes with attributes of a mobile station will be set up, and packet transmission will be performed by the target received power with which the mobile station agreed for the self attribute. Therefore, since the attribute of a mobile station becomes possible [suppressing the transmitted power of the large mobile station of transmitted power in the state of high traffic] in the case of the received power of the electric wave which a base station emits, or the distance between mobile station-connection base stations which measured, the interference power to other cells is mitigated and it is effective in becoming possible to avoid rapid degradation of system performance according to the capture effect.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] the effect of transmitted power control of a system perform packet transmission using a CDMA method -- "effect of the transmitted power control in move packet CDMA communication" 1996 Institute of Electronics and Communication Engineers synthesis convention lecture collected works It is indicated by p.374 communication [1] and March, 1996. If transmitted power control is introduced in the system which performs packet transmission of a slot aloha shirt method using a CDMA method according to this reference, although system capacity (the maximum point of a throughput) will become large, when traffic becomes high and exceeds the maximum point of a throughput, there is a fault that system performance deteriorates rapidly.
[0005] Although all the input-signal power in a base station becomes equal since transmitted power control is performed, if traffic increases, since the number of signals multiplexed by the same frequency band will increase and all the signals of an other station will serve as noise power, this is because it becomes below the level that can receive the SN ratio of the input signal of all mobile stations.
[0006] Moreover, although degradation of the rapid system performance in a high traffic state is not seen since the capture effect is acquired when transmitted power control is not performed in the packet transmission system using the CDMA method, the fault that system capacity (the maximum point of a throughput) is small as compared with the time of transmitted power control exists. Furthermore, the received power in a base station becomes large, so that the distance between base station-mobile stations is near since the transmitted power of the packet in a mobile station is fixed when transmitted power control is not performed. For this reason, the fault that it is large as compared with the receiving probability of a mobile station with the far receiving probability of the transmitting packet of the mobile station near a base station, and communicative unfair nature exists according to the geographical conditions of a mobile station also exists.
[0007] this invention aims at offering the mobile communication system and the transmitted power control method of being made in order to solve the above-mentioned trouble, and being able to enlarge system capacity (the maximum point of a throughput), avoiding degradation of the rapid system performance at the time of high traffic, and easing the unfair nature of communication by the geographical conditions of a mobile station.

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MEANS

[Means for Solving the Problem] this invention consists of two or more mobile stations which exist in the communication region of a base station and a base station, in order to attain the above-mentioned purpose. In the mobile communication system which communicates by the radio channel of the same frequency band between the aforementioned base station and the aforementioned mobile station in the communication region concerned A traffic-measuring means to measure the amount of traffic of a radio channel, Based on the amount of traffic concerning a radio channel, it has a transmitting means to transmit a signal with the transmitted power found on the basis of the target received-power value which agreed with a target received-power calculation means to compute the target received-power value in a base station, for the self attribute.
[0009] In this invention, when system capacity is made to increase and the traffic of a radio channel increases by performing control equivalent to the usual transmitted power control when there is little traffic of a radio channel, based on the attribute of each mobile station, a difference can be prepared in the target received-power value in a base station, and the probability that transmission will be successful with the capture effect can be raised.
[0010]
[Embodiments of the Invention] Hereafter, the example of this invention is explained using a drawing. Drawing 1 is the block diagram showing the system unit composition of the 1st operation gestalt of this invention. In drawing 1 , when two or more mobile stations 11, 12, and 13 in a service area 10 communicate with other terminals which are not illustrated through a base station 20 and a wire circuit 26, using the common access channel 31, each mobile stations 11, 12, and 13 are arbitrary timing, or transmit a packet to a base station 20 synchronizing with a predetermined slot. In addition, four or more mobile stations may exist. Moreover, a method which it may be assigned to the mobile station fixed, for example, and a mobile station chooses at random about allocation of the diffusion sign in a CDMA method from the signs which can receive a base station may be used.
[0011] It will get over with a transmitter-receiver 22, and a base station 20 will output receiving baseband signaling to the baseband signal-processing section 23 and the traffic-measuring section 24, if an antenna 21 receives the signal of the access channel 31 which mobile stations 11, 12, and 13 transmit. In the traffic-measuring section 24, the number of effective receive packets around unit time is measured as an amount of traffic, for example. The traffic-measuring section 24 is outputted to the target received-power information calculation section 25 by making a measurement result into traffic information. The target received-power information calculation section 25 computes a target received-power value from traffic information. The target received-power information which the target received-power information calculation section 25 computes consists of two or more different values for every attribute of a mobile station.
[0012] Drawing 2 is explanatory drawing showing an example of the content of the table used in case a target received-power value is calculated from the number of effective receive packets. Drawing 2 is a table at the time of defining three kinds of mobile station attributes. The table of drawing 2 can consider storing in the memory for example, in the target received-power information calculation section 25. The

target received-power information calculation section 25 calculates the target received-power value corresponding to the traffic information which the traffic-measuring section 24 measured using the table shown in drawing 2 , and outputs it to the baseband processing section 23.
[0013] The target received-power information calculation section 25 is [as opposed to / an attribute 1 / as target received-power information / when the amount THm of traffic which the traffic-measuring section 24 measured now is TH1 < THm < TH2] POW21 from the table of drawing 2 . It is POW22 to an attribute 2. POW23 is calculated from an attribute 3. These target received-power information searched for in the target received-power information calculation section 25 is outputted to the baseband processing section 23.
[0014] although the concrete example of an attribute and target received-power information is mentioned later -- an attribute -- or [for example, / having been measured] -- or it may be the distance from the presumed base station, and when traffic is small, each target received-power information does not have a difference by the difference in an attribute, or is small, and a difference may be expanded, so that traffic becomes large
[0015] The baseband processing section 23 which received target received-power information stores the attribute information on a mobile station, and the target received-power information corresponding to it in the predetermined block of information channel information, and outputs them to a transmitter-receiver 22. A transmitter-receiver 22 transmits a signal including the attribute information on a mobile station, and the target received-power information corresponding to it to mobile stations 11, 12, and 13 through the information channel 30.
[0016] The target received-power information calculation section 25 may calculate a target received-power value by calculation instead of using a table like drawing 2 . In this case, the rule which calculates a target received-power value from traffic information is decided. for example, the difference between the mobile station attributes of the target received-power value POW1 corresponding to the mobile station of an attribute 1 (attribute of the highest priority), and a target received-power value -- the initial value of deltaPOW, and difference -- the rule to which deltaPOW is changed is decided and the target received-power value of each mobile station attribute is calculated for example, the difference in Time t -- deltaPOW (t) is defined as follows
[0017]
[Equation 1]

$$S(t) = \begin{cases} (-1) \times S(t-1) & : \text{THmが前回より減少した時} \\ S(t-1) & : \text{その他の時} \end{cases}$$

（ 但し、$S(0) = 1$ ）

$$\Delta POW(t) = \Delta POW(t-1) \times \alpha^{S(t)}$$

（αは定数：例えば、$\alpha = 1.1$）

[0018] And the target received-power value POWi of each attribute in Time t (t) is calculated by the following formulas.
[0019]
[Equation 2]

$$POW_i(t) = POW_1 - (i-1) \times \Delta POW(t)$$

[0020] This example calculates the amount of traffic based on the number of effective packets which the traffic-measuring section received to per unit time in the base station, and a target received-power calculation means computes target received power by setting up the difference between the calculation values of the target received power corresponding to the aforementioned attribute in adaptation so that the amount of traffic measured with the aforementioned traffic-measuring means may serve as the maximum.
[0021] Drawing 3 is the flow view showing the flow of the mobile stations 11, 12, and 13 in this

operation gestalt of operation. Mobile stations 11, 12, and 13 are in an idle state (S10) in a normal state. If information information is received from a base station 20 in this state, the target received-power information which agreed for the self attribute out of the target received-power information which discards the old target received-power information memorized until now, and exists in the received information information will be chosen, and it will newly memorize as target received-power information (S14), and will return to an idle state S10 again. If the packet which should transmit occurs, mobile stations 11, 12, and 13 will shift to S11, and will compute the transmitted power of a transmitting packet from the target received-power information memorized in a mobile station, and the received power of the information channel 30 (S11). Next, the signal of a transmitting packet is sent out to the access channel 31 with the transmitted power computed by S11 (S12), and it shifts to the response waiting state S13.

[0022] When the information information from a base station 20 is received in the response waiting state S13, target received-power information is updated like an idle state S10 (S15). It ends by generally receiving the confirmation-of-receipt (ACK) signal from a base station 20, and transmitting processing of a packet returns to an idle state (S10) again in this case. When an ACK signal is unreceivable within fixed time, it returns to S11 again and resending processing of a packet is performed.

[0023] When it considers as the received power in the mobile stations 11, 12, and 13 of the signal (for example, signal of the information channel 30) transmitted from the base station 20 while connecting the attribute of mobile stations 11, 12, and 13, for example, when mobile stations 11, 12, and 13 receive information information, measurement of the received power of the information channel 30 is performed simultaneously. Operation (S14, S15) of renewal of target received power is performed for the measured received-power value as attribute information on self.

[0024] In considering as the distance from the base station 20 while connecting the attribute of mobile stations 11, 12, and 13, it carries positioning systems, such as GPS, in a mobile station as for example, a range-measurement means. And the distance between base station-mobile stations is computed within a mobile station by broadcasting the positional information of a base station 20 by the information channel 30. Mobile stations 11, 12, and 13 perform operation of renewal of target received power for the distance between the base station-mobile stations computed by doing in this way as attribute information on self.

[0025] Drawing 4 is a graph which shows change of the transmitted power of the mobile station by the distance at the time of performing the usual transmitted power control. It is not concerned with distance from a base station, but the transmitted power of each mobile station is controlled so that the signal of arbitrary mobile stations is altogether received on the same level in a base station. Distance information actually computes distance using a positioning system, or measures the received power of the information channel from a base station, and presumes it from this value. That is, transmitted power is enlarged when the received power of an information channel is small. Therefore, transmitted power becomes large, so that it goes around a cell, and the disturbance done to a contiguity cell becomes large.

[0026] Drawing 5 is a graph which shows transmitted power control when the amount of traffic in this invention is big. In this case, a target received-power value which divides a mobile station into three attributes according to distance, and illustrates it corresponding to each attribute, for example is assigned. That is, to a base station, on the basis of the mobile station of the attribute 1 of a short distance, only delta POW assigns low power and only 2xdelta POW assigns [as opposed to / the mobile station of the middle-distance attribute 2] low power as opposed to the mobile station of the further long-distance attribute 3. Let assigned power be a value between the power at the time of not performing transmitted power control with the power at the time of performing the usual transmitted power control.

[0027] A big difference arises in the received power in a base station, and the success percentage of packet transmission improves compared with the conventional transmitted power control according to the capture effect, so that for example, the amount of traffic is large by performing such transmitted power control. Moreover, in the periphery of a cell, the transmitted power of a mobile station becomes small rather than the case where the usual transmitted power control is performed, and the disturbance done to a contiguity cell becomes small.

[0028] Drawing 6 is the block diagram showing the composition of the base station in the 2nd operation gestalt of this invention. It sets to drawing 6 . The same sign as drawing 1 is given to the same composition as drawing 1 . With this operation gestalt, a base station 40 reports traffic information, and a mobile station computes target received power by receiving this traffic information. For this reason, as compared with the base station 20 of drawing 1 , the base station 40 of drawing 6 does not have the target received-power calculation section. In the base station 40 of the 2nd operation gestalt, the baseband processing section 23 receives the traffic information measured in the traffic-measuring section 24, traffic information is stored in the predetermined block of information channel information, and it outputs to a transmitter-receiver 22. A transmitter-receiver 22 transmits a signal including traffic information to a mobile station through the information channel 30.
[0029] The mobile station stores beforehand in the memory in a mobile station the same table as the table shown in drawing 2 . And reception of the information information from a base station 40 computes the target received-power information of self using the table of drawing 2 based on the traffic information and the attribute information on self which exist in the received information information. Then, the old target received-power information memorized until now is discarded, and it memorizes in a mobile station by making the newly computed value into target received-power information.
[0030] Operation of a mobile station is the same as that of the flow of operation shown in drawing 3 from traffic information and a table except the point which computes target received-power information at the time of renewal of target received power. Moreover, the method of deciding the rule which calculates a target received-power value from the traffic information explained with the gestalt 1 of operation as a method of computing target received-power information with a mobile station may be used.
[0031] Next, the 3rd operation gestalt of this invention is explained. With this operation gestalt, a base station 20 computes a target received-power setting function based on traffic information. And the parameter which specifies a target received-power setting function is transmitted to a mobile station through the information channel 30. A mobile station reconfigurates a target received-power setting function from the received parameter information, and determines a target received-power value from this target received-power setting function based on the attribute of a local station.
[0032] Since composition and operation are similar with the 1st embodiment the 3rd operative condition, it explains focusing on difference. [like] In the 3rd embodiment, the target received-power setting function calculation section 50 is formed instead of the target received-power information calculation section 25 in the base station 20 of drawing 1 . The target received-power setting function calculation section 50 computes a target received-power setting function from traffic information. The target received-power setting function which the target received-power setting function calculation section 50 computes is a function which sets a horizontal axis a vertical axis as the attribute value of a mobile station as a target received-power value.
[0033] Drawing 7 is explanatory drawing showing an example of a target received-power setting function. The target received-power setting function shown in drawing 7 takes the target received-power value POW0 with a certain fixed attribute value (point of inflection : Rip), and it expresses with the linear function which changes by inclination a with a fixed target received-power value after it. The target received-power setting function calculation section 50 determines point of inflection Rip and inclination a with the parameter which specifies such a target received-power setting function, for example, the target received-power setting function of drawing 7 , using traffic information.
[0034] Drawing 8 is a table used in case it asks for the point of inflection Rip and inclination a which are the parameter information on a target received-power setting function. The table of drawing 8 can consider storing in the memory for example, in the target received-power setting function calculation section 50. The target received-power setting function calculation section 50 asks for the point of inflection Rip and inclination a corresponding to the traffic information which the traffic-measuring section 24 measured using the table shown in drawing 8 , and outputs them to the baseband processing section 23.
[0035] When the amount THm of traffic which the traffic-measuring section 24 measured now is TH1 <

THm < TH2, from the table of drawing 8 , as parameter information on a target received-power setting function, the target received-power setting function calculation section 50 asks for point of inflection with Rip2, and asks for an inclination with a2. These parameter information searched for in the target received-power setting function calculation section 50 is outputted to the baseband processing section 23. It may be set up so that parameter information does not have it when the difference by the difference in the attribute value in target received power has the small amount of traffic, or it is small, and it may be so small that the amount of traffic becomes large so that the amount of traffic becomes large and a difference may be expanded namely, and inclination a may become large. [of point of inflection Rip]
[0036] The baseband processing section 23 which received the parameter information on a target received-power setting function stores parameter information in the predetermined block of information channel information, and outputs it to a transmitter-receiver 22. A transmitter-receiver 22 transmits a signal including parameter information to mobile stations 11, 12, and 13 through the information channel 30. The target received-power setting function calculation section 50 may search for the parameter information on a target received-power setting function by calculation instead of using a table like drawing 8 . In this case, the rule which searches for parameter information from traffic information is decided. For example, point of inflection Rip is made into constant value, and inclination a is changed using traffic information. In addition, as a value of point of inflection Rip, it is good also as 1/2 of the radius of the service area of a base station, for example. The target received-power setting function y in Time t (x t) is decided like the following formulas.
[0037]
[Equation 3]

$$y(x,t)=\begin{cases} POW0 & : \ x < Rip \\ a(t) * x + (POW0 - Rip * a(t)) & : \ その他 \end{cases}$$

[0038] And inclination [in Time t] a (t) is defined as follows.
[0039]
[Equation 4]

$$S(t)=\begin{cases} (-1)\times S(t-1) & : \ THmが前回より減少した時 \\ S(t-1) & : \ その他の時 \end{cases}$$

(但し、S(0)＝1)

$$a(t) = a(t-1)\times \alpha^{S(t)}$$

(αは定数：例えば、α＝1.1)

[0040] The aforementioned target received-power setting function is computed by setting up the inclination of a target received-power setting function in adaptation so that the amount of traffic in which was asked for the amount of traffic and the target received-power setting function calculation means measured it with the traffic-measuring means may serve as the maximum based on the number of effective packets to which the traffic-measuring section received this example to per unit time in the base station.
[0041] Next, operation of the mobile station in the 3rd embodiment is described. In the flow view of the 1st embodiment which showed operation of a mobile station to drawing 3 , it is only that the contents of processing of S14, or S15 and S11 differ, and other processings are the same. If information information is received from a base station 20, in S14 or S15, a mobile station will newly memorize the parameter information which discards the parameter information on the old target received-power setting function memorized until now, and exists in the received information information as parameter information, and will return to an idle state S10 or the response waiting state S13 again.
[0042] If the packet which should transmit occurs, a mobile station will shift to S11, will reconfigurate a target received-power setting function from the parameter information memorized in a mobile station,

and will compute the target received-power value corresponding to the attribute value of a local station. The contents of processing of other steps are the same as the 1st embodiment mentioned above.
[0043] As mentioned above, although the example was indicated, a modification which is described further below is also considered. Although the example which measures the amount of traffic in a base station as an example was indicated, this invention can also be carried out only by the processing by the side of a mobile station by measuring the amount of traffic in a mobile station. For example, you may presume the amount of traffic with the rate of failure of packet transmission. That is, it is regarded as what has many amounts of traffic, so that there is much number of times of resending of a packet, and according to the number of times of resending of a packet, it may be made to enlarge the power difference by attribute value.
[0044] The example which adopts the received power of the information channel corresponding to the measured distance or this distance from a base station mostly as an attribute is indicated, and although it decreases rather than the case where the disturbance done to the adjoining cell performs transmitted power control equally in the case of this example, there is a trouble that the mobile station near a base station will be advantageous. In order to solve this, a mobile station is divided into two or more groups at random, and a different attribute for every group is assigned. And this assignment is changed one by one a fixed period. If it does in this way, a priority changes periodically, and it will become equal if it averages. Moreover, you may make it in the case of emergency intelligence etc., correct the attribute of a terminal according to the attribute of data so that a target received-power value may become large.
[0045] Although the amount of traffic to measure indicated the example which is the number of effective receive packets for every predetermined time, when traffic increases extremely, reception of a packet becomes impossible, and it also has a possibility that the number of effective receive packets may decrease on the contrary. Then, you may make it presume the amount of traffic from the total received power in a base station.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the system unit composition of the 1st example of this invention.
[Drawing 2] It is explanatory drawing showing an example of the table which calculates a target received-power value.
[Drawing 3] It is the flow view showing the flow of a mobile station of operation.
[Drawing 4] It is the graph which shows change of the transmitted power in the usual transmitted power control.
[Drawing 5] It is the graph which shows transmitted power change when the amount of traffic is big.
[Drawing 6] It is the block diagram showing the base station composition in the 2nd example of this invention.
[Drawing 7] It is explanatory drawing showing an example of a target received-power setting function.
[Drawing 8] It is explanatory drawing showing an example of the table which searches for the parameter information on a target received-power setting function.
[Description of Notations]
10 [-- A base station, 21 / -- An antenna, 22 / -- A transmitter-receiver, 23 / -- The baseband processing section, 24 / -- The traffic-measuring section, 25 / -- The target received-power calculation section 26 / -- A wire circuit, 30 / -- An information channel, 31 / -- Access channel] -- A service area, 11, 12, 13 -- 20 A mobile station, 40

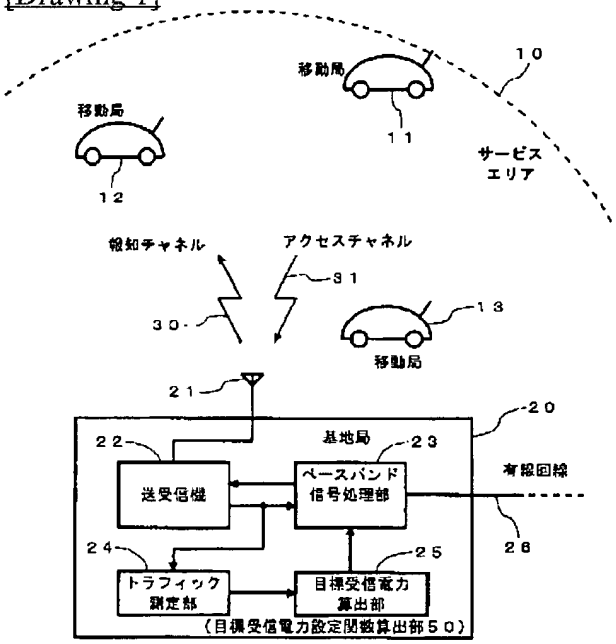
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

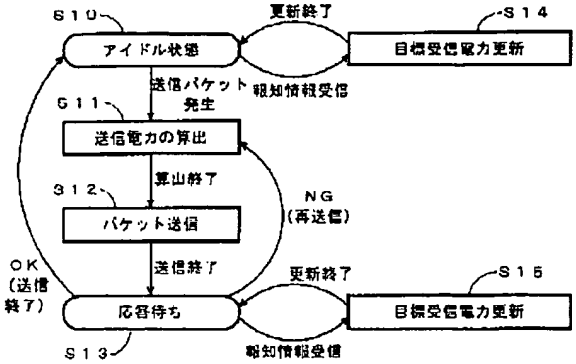
[Drawing 1]



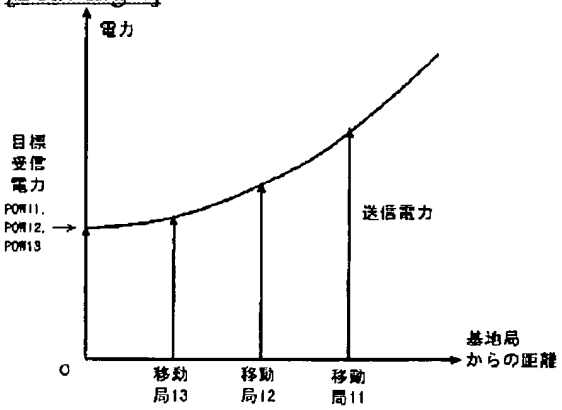
[Drawing 2]

測定トラフィック量	目標受信電力		
	属性1	属性2	属性3
～ TH1	POW11	POW12	POW13
TH1 ～ TH2	POW21	POW22	POW23
TH2 ～ TH3	POW31	POW32	POW33
TH3 ～ TH4	POW41	POW42	POW43
TH4 ～	POW51	POW52	POW53

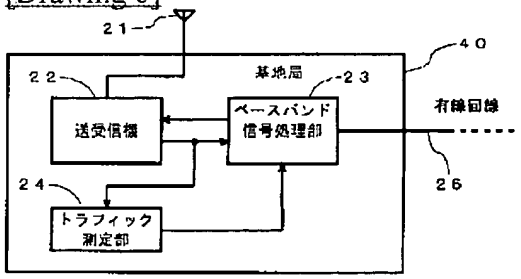
[Drawing 3]



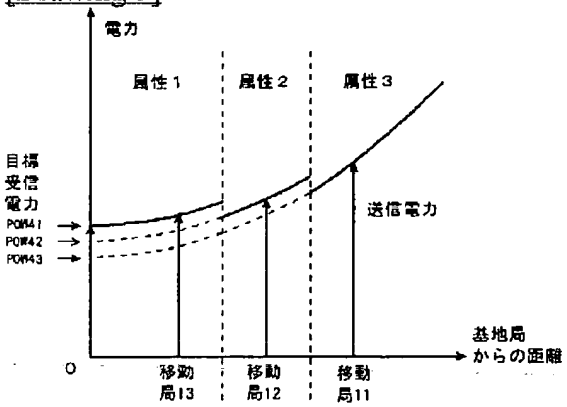
[Drawing 4]



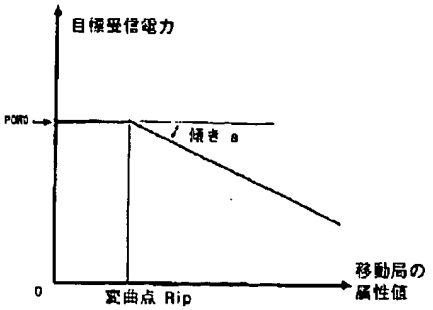
[Drawing 6]



[Drawing 5]



[Drawing 7]



[Drawing 8]

測定トラフィック量	パラメータ値	
	変曲点	傾き
～ TH1	Rip1	a1
TH1 ～ TH2	Rip2	a2
TH2 ～ TH3	Rip3	a3
TH3 ～ TH4	Rip4	a4
TH4 ～	Rip5	a5

[Translation done.]

FOREIGN PATENT REQUEST FORM

Requestor's Name: TANMAY LELE		Case Serial Number: 10/072056
Request Date: ~~July 14, 2003~~	Art Unit/Org.: 2684	Building: CPK2 Room: 8B39
Date Needed By: NO NIL	Phone: 305-3462	FAX Number:

Requests may be submitted by e-mail. Include on the e-mail the same information requested on this form.

COUNTRY NAME or COUNTRY CODE	DOCUMENT NUMBER	DOCUMENT DATE
JAPAN	JP-11-298407A	29 Oct 1999

COMPLETED

Staff Use Only

Searcher Name: _____ Date Filled: _____

Examiner contacted:

☐ YES - Date called or e-mailed: _____

☐ NO

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/04514

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[6] H04B7/26, 102

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[6] H04B7/26-7/26, 102
H04Q7/00-7/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1999 Toroku Jitsuyo Shinan Koho 1994-1999
Kokai Jitsuyo Shinan Koho 1971-1999

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	"CDMA Slotted-ALOHA; Packet Tsushin ni okeru Soushin Denryoku Seigyo no ichi Kentou", Technical research report, the Institute of Electronics, Information and Communication Engineers, Vol.98, No.159, pp.95-102 (1998)	1,2,6-10,15,16 3,4,11-13,17, 18
EX EA	JP, 11-298407, A (YRP Idou Tsushin Kiban Gijutsu Kenkyusho K.K.), 29 October, 1999 (29.10.99) (Family: none)	1-4,6-10,15-18 11-13

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
04 November, 1999 (04.11.99)	24 November, 1999 (24.11.99)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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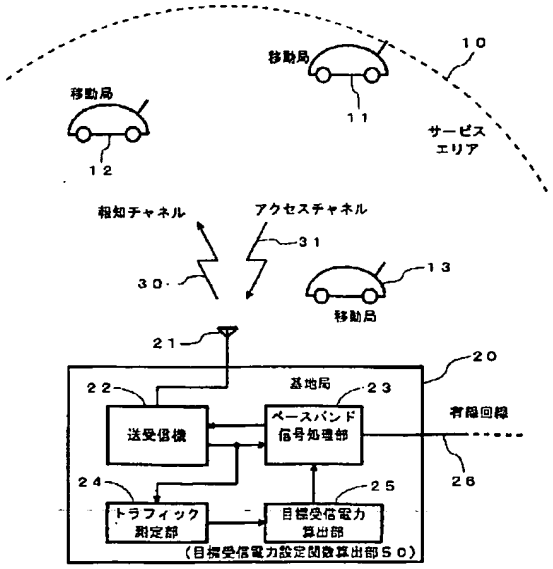
(54)【発明の名称】　移動体通信システム、基地局装置、移動局装置および送信電力制御方法

(57)【要約】

【課題】　CDMA方式で送信電力制御を行うパケット伝送システムにおいて、システム容量を大きくするとともに、高トラフィック状態においても急激なシステム性能の劣化を回避する移動体通信システムおよび送信電力制御方式を提供する。

【解決手段】　基地局はトラフィック量を測定し、該測定量に基づいて、移動局の送信パケットの目標受信電力値あるいは目標受信電力設定関数を算出して、移動局に目標受信電力あるいは関数のパラメータ情報を報知する。移動局は属性に基づき目標受信電力情報を選択するか、あるいは関数を再構成して目標受信電力値を算出し、目標受信電力値を基準にして求めた送信電力でパケットを送信する。移動局でトラフィック量を測定あるいは推定してもよい。高トラフィック時に基地局での受信電力に差が生じ、キャプチャー効果によって伝送成功率が向上する。



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【特許請求の範囲】

【請求項１】　基地局と前記基地局の通信領域に存在する複数の移動局により構成され、前記基地局と前記移動局との間において、無線チャネルにより通信を行う移動体通信システムにおいて、

前記無線チャネルのトラフィック量を測定するトラフィック測定手段と、

測定されたトラフィック量および前記移動局の属性に基づいて、前記基地局が受信する信号の目標受信電力値を算出する目標受信電力算出手段と、

移動局が、前記目標受信電力値を基準にして送信電力値を算出し、該送信電力値で信号を送信する送信手段を有することを特徴とする移動体通信システム。

【請求項２】　前記トラフィック測定手段は前記基地局に設けられ、

前記目標受信電力算出手段は前記基地局に設けられ、前記基地局が受信する信号の目標受信電力値を前記移動局の属性に応じて複数個算出するものであり、

前記基地局は、更に前記属性毎に算出された全ての前記目標受信電力情報を前記移動局に通知する目標受信電力情報通知手段を備え、

前記移動局は、前記目標受信電力情報を受信する目標受信電力情報受信手段を備え、

前記送信手段は、受信した前記目標受信電力情報の中から自局の属性に対応した目標受信電力値を選択し、選択した目標受信電力値を基準にして送信信号の送信電力値を算出するものであることを特徴とする請求項１に記載の移動体通信システム。

【請求項３】　前記トラフィック測定手段は前記基地局に設けられ、

更に前記基地局は前記移動局に前記トラフィック量を通知するトラフィック情報通知手段を備え、

前記移動局は、前記トラフィック量情報を受信するトラフィック情報受信手段を備え、

前記目標受信電力算出手段は前記移動局に設けられ、前記属性と前記基地局から受信したトラフィック量情報に基づいて目標受信電力値を算出するものであることを特徴とする請求項１に記載の移動体通信システム。

【請求項４】　前記トラフィック測定手段は前記基地局に設けられ、

前記目標受信電力算出手段は、前記基地局に設けられた、前記トラフィック測定手段の出力に基づき関数を決定する目標受信電力設定関数算出手段と、前記目標受信電力設定関数算出手段で算出した前記目標受信電力設定関数を特定するパラメータ情報を前記移動局に通知する設定関数情報通知手段を備え、かつ、前記移動局に設けられた、前記パラメータ情報を受信する設定関数情報受信手段と、受信した前記パラメータ情報から目標受信電力設定関数を再構成し、自局の属性に基づいて該目標受信電力設定関数から目標受信電力値を決定する目標受信

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電力値決定手段とからなるものであることを特徴とする請求項１に記載の移動体通信システム。

【請求項５】　前記属性は、移動局において測定された前記移動局と前記基地局間の距離情報に基づいて決定されることを特徴とする請求項１乃至４に記載の移動体通信システム。

【請求項６】　前記属性は、前記移動局において受信された前記基地局からの信号電力値に基づいて決定されることを特徴とする請求項１乃至４に記載の移動体通信システム。

【請求項７】　前記目標受信電力算出手段は、前記トラフィック測定手段で測定したトラフィック量に基づき、前記属性に対応した目標受信電力の算出値間の差分を適応的に設定して前記目標受信電力を算出することを特徴とする請求項１乃至３に記載の移動体通信システム。

【請求項８】　前記目標受信電力設定関数は、所定の属性値以下は一定の目標受信電力値をとり、前記所定の属性値以上は目標受信電力値が一定の傾きで変化する一次関数で表わせることを特徴とする請求項４に記載の移動体通信システム。

【請求項９】　移動局の属性が移動局において測定された該移動局と前記基地局間の距離情報に基づいて決定され、前記所定の属性値を、前記基地局のサービスエリアの半径の１／２とすることを特徴とする請求項８に記載の移動体通信システム。

【請求項１０】　前記目標受信電力設定関数算出手段は、前記トラフィック測定手段で測定したトラフィック量に基づき、前記目標受信電力設定関数の傾きを適応的に設定して前記目標受信電力設定関数を算出することを特徴とする請求項８あるいは９に記載の移動体通信システム。

【請求項１１】　前記トラフィック測定部は、単位時間当たりに基地局で受信した有効パケット数に基づきトラフィック量を求め、

前記目標受信電力算出手段は、前記トラフィック測定手段で測定したトラフィック量が大きくなるように、前記属性に対応した目標受信電力の算出値間の差分を適応的に設定して前記目標受信電力を算出することを特徴とする請求項１乃至３に記載の移動体通信システム。

【請求項１２】　前記トラフィック測定部は、単位時間当たりに基地局で受信した有効パケット数に基づきトラフィック量を求め、

前記目標受信電力設定関数算出手段は、前記トラフィック測定手段で測定したトラフィック量が大きくなるように、前記目標受信電力設定関数の傾きを適応的に設定して前記目標受信電力設定関数を算出することを特徴とする請求項８乃至１０に記載の移動体通信システム。

【請求項１３】　基地局と前記基地局の通信領域に存在する複数の移動局により構成され、前記基地局と前記移動局との間において、無線チャネルにより通信を行う移

動体通信システムにおいて使用される基地局装置であって、
トラフィック測定手段と、
測定されたトラフィック量および移動局の属性に応じて基地局が受信する信号の目標受信電力値を複数個算出する目標受信電力算出手段と、
前記属性毎に算出された全ての前記目標受信電力情報を前記移動局に通知する目標受信電力情報通知手段とを備えたことを特徴とする基地局装置。

【請求項14】　基地局と前記基地局の通信領域に存在する複数の移動局により構成され、前記基地局と前記移動局との間において、無線チャネルにより通信を行う移動体通信システムにおいて使用される基地局装置であって、
トラフィック測定手段と、
移動局にトラフィック量を通知するトラフィック情報通知手段とを備えたことを特徴とする基地局装置。

【請求項15】　基地局と前記基地局の通信領域に存在する複数の移動局により構成され、前記基地局と前記移動局との間において、無線チャネルにより通信を行う移動体通信システムにおいて使用される基地局装置であって、
トラフィック測定手段と、
前記トラフィック測定手段の出力に基づき関数を決定する目標受信電力設定関数算出手段と、
前記目標受信電力設定関数算出手段で算出した前記目標受信電力設定関数を特定するパラメータ情報を前記移動局に通知する設定関数情報通知手段と、を備えたことを特徴とする基地局装置。

【請求項16】　基地局と前記基地局の通信領域に存在する複数の移動局により構成され、前記基地局と前記移動局との間において、無線チャネルにより通信を行う移動体通信システムにおいて使用される移動局装置であって、
目標受信電力情報を受信し、受信した前記目標受信電力情報の中から自局の属性に対応した目標受信電力値を選択する目標受信電力値生成手段と、
目標受信電力値を基準にして送信信号の送信電力値を算出する送信手段とを備えたことを特徴とする移動局装置。

【請求項17】　基地局と前記基地局の通信領域に存在する複数の移動局により構成され、前記基地局と前記移動局との間において、無線チャネルにより通信を行う移動体通信システムにおいて使用される移動局装置であって、
トラフィック量情報を受信し、自局の属性と前記トラフィック量情報に基づいて目標受信電力値を算出する目標受信電力値生成手段と、
目標受信電力値を基準にして送信信号の送信電力値を算出する送信手段とを備えたことを特徴とする移動局装置。

【請求項18】　基地局と前記基地局の通信領域に存在する複数の移動局により構成され、前記基地局と前記移動局との間において、無線チャネルにより通信を行う移動体通信システムにおいて使用される移動局装置であって、
前記目標受信電力設定関数を特定するパラメータ情報を受信する設定関数情報受信手段と、
受信した前記パラメータ情報から目標受信電力設定関数を再構成し、自局の属性に基づいて該目標受信電力設定関数から目標受信電力値を決定する目標受信電力値生成手段と、
目標受信電力値を基準にして送信信号の送信電力値を算出する送信手段とを備えたことを特徴とする移動局装置。

【請求項19】　基地局と前記基地局の通信領域に存在する複数の移動局により構成され、前記基地局と前記移動局との間において、無線チャネルにより通信を行う移動体通信システムにおいて実施され、
前記無線チャネルのトラフィック量を測定する第1の工程と、
測定されたトラフィック量および前記移動局の属性に基づいて、前記基地局が受信する信号の目標受信電力値を算出する第2の工程と、
移動局が、前記目標受信電力値を基準にして送信電力値を算出し、該送信電力値で信号を送信する第3の工程とを含むことを特徴とする送信電力制御方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、移動体通信システム、基地局装置、移動局装置および送信電力制御方法に関し、特に、複数の移動局と基地局間のパケット通信を共通のチャネルを用いてCDMA（符号分割多元接続）方式によりランダムアクセスする移動体通信システム、基地局装置、移動局装置および送信電力制御方法に関する。

【0002】

【従来の技術】多元接続方式にCDMA（符号分割多元接続）方式を利用した移動体通信システムの移動局から基地局への上り回線における通信では、各々の移動局からの信号の基地局での受信電力が基地局―移動局間距離の違いにより異なるために起こる性能劣化（いわゆる遠近問題）が大きな問題となる。この遠近問題を軽減するために、CDMA方式を利用した移動体通信システムでは一般的に、各々の移動局からの信号の基地局での受信電力が等しくなるように移動局送信時の送信電力を制御する送信電力制御が行われている。

【0003】一方、無線パケット伝送システムでは、携帯電話システムのように発呼時に空きチャネルを割り当てるようなチャネル制御は行わず、例えばスロットアロ

ハ方式のように、スロットに同期して同一チャネルで直ちにデータパケットを送信する方式が用いられる。この場合には多数の信号が衝突する可能性があるが、狭帯域系の多元接続方式（FDMA,TDMA方式）を採用したシステムでは各々の移動局からの信号の基地局での受信電力差により、衝突状態においてもある条件のもとでパケット受信が可能になるという効果（いわゆるキャプチャー効果）があることが知られている。

【０００４】

【発明が解決しようとする課題】CDMA方式を利用してパケット伝送を行うシステムの送信電力制御の効果について、「移動パケットCDMA通信における送信電力制御の効果」，１９９６年電子通信学会総合大会講演論文集 通信〔1〕，1996年3月，p.374に記載されている。この文献によれば、CDMA方式を利用してスロットアロハ方式のパケット伝送を行うシステムにおいて送信電力制御を導入すると、システム容量（スループットの最大点）は大きくなるが、トラフィックが高くなり、スループットの最大点を超えると急激にシステム性能が劣化するという欠点がある。

【０００５】これは、送信電力制御を行っているために基地局における受信信号電力が皆等しくなるが、トラフィックが増加すると、同じ周波数帯域で多重化される信号数が増加し、他局の信号が全て雑音電力となるために、全ての移動局の受信信号のＳＮ比が受信可能なレベル以下となってしまうためである。

【０００６】また、CDMA方式を利用したパケット伝送システムにおいて送信電力制御を行わなかった場合、キャプチャー効果が得られるために高トラフィック状態での急激なシステム性能の劣化は見られないが、システム容量（スループットの最大点）が送信電力制御時に比較して小さいという欠点が存在する。さらに、送信電力制御を行わなかった場合、移動局でのパケットの送信電力が一定であるため、基地局－移動局間距離が近いほど基地局における受信電力が大きくなる。このため、基地局に近い移動局の送信パケットの受信確率が遠い移動局の受信確率に比較して大きく、移動局の地理的条件により通信の不公平性が存在するという欠点も存在する。

【０００７】本発明は、上記の問題点を解決するためになされたものであり、システム容量（スループットの最大点）を大きくし、かつ、高トラフィック時の急激なシステム性能の劣化を回避し、また、移動局の地理的条件による通信の不公平性を緩和することができる移動体通信システムおよび送信電力制御方法を提供することを目的とする。

【０００８】

【課題を解決するための手段】本発明は、上記目的を達成するために、基地局と基地局の通信領域に存在する複数の移動局で構成され、前記基地局と当該通信領域内の前記移動局との間において同一周波数帯域の無線チャネルにより通信を行う移動体通信システムにおいて、無線チャネルのトラフィック量を測定するトラフィック測定手段と、無線チャネルにかかるトラフィック量に基づいて、基地局における目標受信電力値を算出する目標受信電力算出手段と、自己の属性に合致した目標受信電力値を基準にして求めた送信電力で信号を送信する送信手段を有する。

【０００９】本発明においては、無線チャネルのトラフィックが少ない場合には、通常の送信電力制御と同等の制御を行うことにより、システム容量を増加させ、また、無線チャネルのトラフィックが増加した場合には、個々の移動局の属性に基づき、基地局における目標受信電力値に差を設け、キャプチャー効果によって伝送が成功する確率を向上させることができる。

【００１０】

【発明の実施の形態】以下、図面を用いて本発明の実施例を説明する。図１は、本発明の第１の実施形態のシステム装置構成を示すブロック図である。図１において、サービスエリア１０内の複数の移動局１１、１２、１３が基地局２０、有線回線２６を介して図示しない他の端末と通信を行う場合に、各移動局１１、１２、１３は共通のアクセスチャネル３１を使用して任意のタイミングで、あるいは所定のスロットに同期して基地局２０にパケットを送信する。なお、移動局は４個以上存在しても良い。また、CDMA方式における拡散符号の割当てについては、例えば移動局に固定的に割り当てられていてもよいし、基地局が受信可能な符号の中から移動局がランダムに選択するような方式でもよい。

【００１１】基地局２０は、移動局１１、１２、１３が送信するアクセスチャネル３１の信号をアンテナ２１で受信すると、送受信機２２で復調し、受信ベースバンド信号をベースバンド信号処理部２３およびトラフィック測定部２４へ出力する。トラフィック測定部２４では、例えば、トラフィック量として単位時間あたりの有効受信パケット数を測定する。トラフィック測定部２４は、測定結果をトラフィック情報として、目標受信電力情報算出部２５に出力する。目標受信電力情報算出部２５は、トラフィック情報から目標受信電力値を算出する。目標受信電力情報算出部２５が算出する目標受信電力情報は、移動局の属性毎に異なる複数の値から構成される。

【００１２】図２は、有効受信パケット数から目標受信電力値を求める際に使用するテーブルの内容の一例を示す説明図である。図２は、３種類の移動局属性を定義した場合のテーブルである。図２のテーブルは、例えば、目標受信電力情報算出部２５内のメモリに格納しておくことが考えられる。目標受信電力情報算出部２５は、図２に示すテーブルを用いて、トラフィック測定部２４が測定したトラフィック情報に対応する目標受信電力値を求め、ベースバンド処理部２３に出力する。

【００１３】今、トラフィック測定部２４が測定したトラフィック量THmがTH1 < THm < TH2の場合、目標受信電力情報算出部２５は、図２のテーブルより目標受信電力情報として、属性１に対してPOW21，属性２に対してPOW22，属性３に対してPOW23を求める。目標受信電力情報算出部２５で求められたこれらの目標受信電力情報は、ベースバンド処理部２３に出力される。

【００１４】属性および目標受信電力情報の具体的な例は後述するが、属性は例えば測定されたかあるいは推定された基地局からの距離であってもよく、また各目標受信電力情報はトラフィックが小さいときには属性の違いによる差が無いか小さく、トラフィックが大きくなるほど差が拡大するものであってもよい。

【００１５】目標受信電力情報を受信したベースバンド処理部２３は、報知チャネル情報の所定のブロックに移動局の属性情報とそれに対応する目標受信電力情報を格＊納して、送受信機２２に出力する。送受信機２２は、移動局の属性情報とそれに対応する目標受信電力情報を含む信号を報知チャネル３０を通じて移動局１１、１２、１３へ送信する。

【００１６】目標受信電力情報算出部２５は、図２のようなテーブルを使用する代わりに、計算によって目標受信電力値を求めても良い。この場合には、トラフィック情報から目標受信電力値を求める規則を決めておく。例えば、属性１（最優先属性）の移動局に対応する目標受信電力値ＰＯＷ1、目標受信電力値の移動局属性間の差分ΔＰＯＷの初期値および差分ΔＰＯＷを変化させる規則を決めておき、各移動局属性の目標受信電力値を求める。例えば、時間ｔでの差分ΔＰＯＷ（ｔ）を以下のように定義する。

【００１７】

【数１】

$$S(t)=\begin{cases}(-1)\times S(t-1) & : THmが前回より減少した時\\ S(t-1) & : その他の時\end{cases}$$

（　但し、Ｓ(0)＝１　）

$$\Delta POW(t)=\Delta POW(t-1)\times \alpha^{S(t)}$$

（αは定数：例えば、α＝1.1）

【００１８】そして、時間ｔでの各々の属性の目標受信電力値ＰＯＷi(ｔ)を以下の式によって求める。

【００１９】

【数２】

$$POW_i(t)=POW_1-(i-1)\times \Delta POW(t)$$

【００２０】この例は、トラフィック測定部が、単位時間当たりに基地局で受信した有効パケット数に基づきトラフィック量を求め、目標受信電力算出手段は、前記トラフィック測定手段で測定したトラフィック量が最大となるように、前記属性に対応した目標受信電力の算出値間の差分を適応的に設定して、目標受信電力を算出するものである。

【００２１】図３は、本実施形態における移動局１１、１２、１３の動作フローを示すフロー図である。移動局１１、１２、１３は通常状態においては、アイドル状態（Ｓ１０）にある。この状態において基地局２０から報知情報を受信すると、これまで記憶していた古い目標受信電力情報を廃棄し、受信した報知情報の中に存在する目標受信電力情報の中から自己の属性に合致した目標受信電力情報を選択し、新たに目標受信電力情報として記憶し（Ｓ１４）、再びアイドル状態Ｓ１０に復帰する。移動局１１，１２、１３は、送信すべきパケットが発生すると、Ｓ１１に移行して、移動局内に記憶している目標受信電力情報と、報知チャネル３０の受信電力から送信パケットの送信電力を算出する（Ｓ１１）。次に、Ｓ１１で算出した送信電力で送信パケットの信号をアクセスチャネル３１に送出し（Ｓ１２）、応答待ち状態Ｓ１※３に移行する。

【００２２】応答待ち状態Ｓ１３において基地局２０からの報知情報を受信した場合には、アイドル状態Ｓ１０と同様に目標受信電力情報の更新処理を行う（Ｓ１５）。パケットの送信処理は、一般的に基地局２０からの受信確認（ＡＣＫ）信号を受信することで終了し、この場合には再びアイドル状態（Ｓ１０）に戻る。一定時間内にＡＣＫ信号が受信できなかった場合は、再びＳ１１に戻りパケットの再送処理を行う。

【００２３】移動局１１、１２、１３の属性を接続中の基地局２０から送信される信号（例えば、報知チャネル３０の信号）の移動局１１、１２、１３における受信電力とした場合は、例えば、移動局１１、１２、１３が報知情報を受信する場合に報知チャネル３０の受信電力の測定を同時に実行する。測定した受信電力値を自己の属性情報として目標受信電力更新の動作（Ｓ１４、Ｓ１５）を実行する。

【００２４】移動局１１、１２、１３の属性を接続中の基地局２０からの距離とする場合には、例えば距離測定手段として、ＧＰＳなどの測位システムを移動局に搭載する。そして、報知チャネル３０で基地局２０の位置情報を放送することにより、移動局内で基地局―移動局間の距離を算出する。移動局１１、１２、１３は、このようにして算出された基地局―移動局間の距離を自己の属性情報として目標受信電力更新の動作を実行する。

【００２５】図４は、通常の送信電力制御を行った場合の距離による移動局の送信電力の変化を示すグラフであ

る。基地局からの距離に関わらず、任意の移動局の信号が基地局において全て同じレベルで受信されるように各移動局の送信電力が制御される。距離情報は実際に測位システムを使用して距離を算出するか、あるいは基地局からの報知チャネルの受信電力を測定して、この値から推定する。即ち、報知チャネルの受信電力が小さい場合には送信電力を大きくする。従って、セルの周辺にいくほど送信電力が大きくなり、隣接セルに与える妨害が大きくなる。

【００２６】図５は、本発明におけるトラフィック量が大きな場合の送信電力制御を示すグラフである。この場合には例えば、移動局を距離によって３つの属性に分け、それぞれの属性に対応して図示するような目標受信電力値を割り当てる。即ち、基地局に対して近距離の属性１の移動局を基準として、中距離の属性２の移動局に対しては例えば、ΔPOWだけ低い電力を割り当て、更に遠距離の属性３の移動局に対しては例えば、２×ΔPOWだけ低い電力を割り当てる。割り当てた電力は例えば、通常の送信電力制御を行った場合の電力と送信電力制御を行わなかった場合の電力との間の値とする。

【００２７】このような送信電力制御を行うことにより、例えばトラフィック量が大きいほど、基地局における受信電力に大きな差が生じ、キャプチャー効果によってパケット送信の成功率が従来の送信電力制御に比べて向上する。また、セルの周辺部においては、通常の送信電力制御を行った場合よりも移動局の送信電力が小さくなり、隣接セルに与える妨害が小さくなる。

【００２８】図６は、本発明の第２の実施形態における基地局の構成を示すブロック図である。図６において、図１と同一の構成には図１と同一の符号が付してある。本実施形態では、基地局４０がトラフィック情報を報知し、移動局は該トラフィック情報を受信して目標受信電力を算出する。このため、図１の基地局２０と比較して、図６の基地局４０は目標受信電力算出部を持たない。 第２の実施形態の基地局４０では、トラフィック測定部２４で測定したトラフィック情報をベースバンド処理部２３が受け取り、報知チャネル情報の所定のブロックにトラフィック情報を格納して、送受信機２２に出力する。送受信機２２は、トラフィック情報を含む信号を報知チャネル３０を通じて移動局へ送信する。

【００２９】移動局は、図２に示したテーブルと同一のテーブルを移動局内のメモリに予め格納している。そして、基地局４０からの報知情報を受信すると、受信した報知情報の中に存在するトラフィック情報および自己の属性情報に基づき、図２のテーブルを使用して自己の目標受信電力情報を算出する。その後、これまで記憶していた古い目標受信電力情報を廃棄し、新たに算出した値を目標受信電力情報として移動局内に記憶する。

【００３０】移動局の動作は、目標受信電力更新時にトラフィック情報とテーブルから目標受信電力情報を算出する点以外は、図３に示す動作フローと同一である。また、移動局で目標受信電力情報を算出する方法としては、実施の形態１で説明したトラフィック情報から目標受信電力値を求める規則を決めておく方法でも良い。

【００３１】次に、本発明の第３の実施形態について説明する。本実施形態では、基地局２０がトラフィック情報に基づき、目標受信電力設定関数を算出する。そして、目標受信電力設定関数を特定するパラメータを報知チャネル３０を通じて移動局へ送信する。移動局は受信したパラメータ情報から目標受信電力設定関数を再構成し、自局の属性に基づいて該目標受信電力設定関数から目標受信電力値を決定する。

【００３２】第３実施態様の構成および動作は第１の実施態様と類似しているので、相違点を中心に説明する。第３の実施態様においては、図１の基地局２０内の目標受信電力情報算出部２５の代わりに目標受信電力設定関数算出部５０を設ける。目標受信電力設定関数算出部５０は、トラフィック情報から目標受信電力設定関数を算出する。目標受信電力設定関数算出部５０が算出する目標受信電力設定関数は、移動局の属性値を横軸に目標受信電力値を縦軸とする関数である。

【００３３】図７は、目標受信電力設定関数の一例を示す説明図である。図７に示した目標受信電力設定関数は、ある属性値(変曲点：Rip)までは一定の目標受信電力値POW0をとり、それ以降は目標受信電力値が一定の傾きａで変化する一次関数で表わしたものである。目標受信電力設定関数算出部５０は、このような目標受信電力設定関数を特定するパラメータ、例えば、図７の目標受信電力設定関数では、変曲点Ripおよび傾きａをトラフィック情報により決定する。

【００３４】図８は、目標受信電力設定関数のパラメータ情報である変曲点Ripおよび傾きａを求める際に使用するテーブルである。図８のテーブルは、例えば、目標受信電力設定関数算出部５０内のメモリに格納しておくことが考えられる。目標受信電力設定関数算出部５０は、図８に示すテーブルを用いて、トラフィック測定部２４が測定したトラフィック情報に対応する変曲点Ripおよび傾きａを求め、ベースバンド処理部２３に出力する。

【００３５】今、トラフィック測定部２４が測定したトラフィック量THmがTH1 < THm < TH2の場合、目標受信電力設定関数算出部５０は、図８のテーブルより目標受信電力設定関数のパラメータ情報として、変曲点をRip2,傾きをａ2と求める。目標受信電力設定関数算出部５０で求められたこれらのパラメータ情報は、ベースバンド処理部２３に出力される。パラメータ情報は、目標受信電力における属性値の違いによる差が、トラフィック量が小さいときには無いか小さく、トラフィック量が大きくなるほど差が拡大するように、即ち、トラフィック量が大きくなるほど変曲点Ripが小さく、傾きａが大きく

なるように設定されるものであってもよい。

【００３６】目標受信電力設定関数のパラメータ情報を受信したベースバンド処理部２３は、報知チャネル情報の所定のブロックにパラメータ情報を格納して、送受信機２２に出力する。送受信機２２は、パラメータ情報を含む信号を報知チャネル３０を通じて移動局１１、１２、１３へ送信する。目標受信電力設定関数算出部５０は、図8のようなテーブルを使用する代わりに、計算によって目標受信電力設定関数のパラメータ情報を求めて＊も良い。この場合には、トラフィック情報からパラメータ情報を求める規則を決めておく。例えば、変曲点Ripを一定値とし、傾きａをトラフィック情報により変化させる。なお、変曲点Ripの値としては、例えば基地局のサービスエリアの半径の１／２としてもよい。時間ｔでの目標受信電力設定関数ｙ(x,t)を以下の式のように決めておく。

【００３７】

【数３】

$$y(x,t)=\begin{cases} POW0 & : \ x < Rip \\ a(t) * x + (POW0 - Rip * a(t)) & : \ その他 \end{cases}$$

【００３８】そして、時間ｔでの傾きａ(t)を以下のように定義する。

※【００３９】

※【数４】

$$S(t)=\begin{cases} (-1)\times S(t-1) & : \ THmが前回より減少した時 \\ S(t-1) & : \ その他の時 \end{cases}$$

（　但し、S(0)＝1　）

$$a(t) = a(t-1)\times \alpha^{S(t)}$$

（αは定数：例えば、α＝1.1）

【００４０】この例は、トラフィック測定部が単位時間当たりに基地局で受信した有効パケット数に基づきトラフィック量を求め、目標受信電力設定関数算出手段は、トラフィック測定手段で測定したトラフィック量が最大となるように、目標受信電力設定関数の傾きを適応的に設定して前記目標受信電力設定関数を算出するものである。

【００４１】次に、第３の実施態様における移動局の動作について述べる。移動局の動作は図３に示した第１の実施態様のフロー図においてＳ１４あるいはＳ１５およびＳ１１の処理内容が異なるのみであり、その他の処理は同一である。移動局は基地局２０から報知情報を受信すると、Ｓ１４あるいはＳ１５において、これまで記憶していた古い目標受信電力設定関数のパラメータ情報を廃棄し、受信した報知情報の中に存在するパラメータ情報を新たにパラメータ情報として記憶し、再びアイドル状態Ｓ１０あるいは応答待ち状態Ｓ１３に復帰する。

【００４２】移動局は、送信すべきパケットが発生すると、Ｓ１１に移行して、移動局内に記憶しているパラメータ情報から目標受信電力設定関数を再構成し、自局の属性値に対応した目標受信電力値を算出する。その他のステップの処理内容は前述した第１の実施態様と同じである。

【００４３】以上、実施例を開示したが、更に以下に述べるような変形例も考えられる。実施例としては、基地局においてトラフィック量を測定する例を開示したが、移動局においてトラフィック量を測定することにより、移動局側の処理のみで本発明を実施することもできる。例えば、パケット送信の失敗率によってトラフィック量★を推定してもよい。即ち、パケットの再送回数が多いほどトラフィック量が多いものと見なし、パケットの再送回数に応じて属性値による電力差を大きくするようにしてもよい。

【００４４】属性としては、測定した基地局からの距離あるいは該距離にほぼ対応する報知チャネルの受信電力を採用する例を開示し、この例の場合には、隣接するセルに与える妨害は均等に送信電力制御を行った場合よりも減少するが、基地局に近い移動局が有利となってしまうという問題点がある。これを解決するためには、例えば、移動局をランダムに複数の群に分け、群ごとに異なる属性を割り当てる。そしてこの割り当てを一定の周期で順次変更する。このようにすれば、優先度が周期的に変化し、平均すると均等になる。また、緊急情報などの場合には目標受信電力値が大きくなるように、データの属性によって端末の属性を修正するようにしてもよい。

【００４５】測定するトラフィック量は、所定時間ごとの有効受信パケット数である例を開示したが、極端にトラフィックが増加した場合にはパケットの受信が不可能になり、有効受信パケット数がかえって減少してしまう恐れもある。そこで、基地局における全受信電力からトラフィック量を推定するようにしてもよい。

【００４６】

【発明の効果】以上説明したように、本発明の移動体通信システムおよび送信電力制御方式によれば、トラフィック量が小さい時には、目標受信電力を移動局の属性によらず一定にし、トラフィック量が大きくなると、移動局の属性により異なる目標受信電力を設定し、移動局が自己の属性に合致した目標受信電力でパケット送信を行

う。従って、移動局の属性が、基地局の発する電波の受信電力や測定した移動局一接続基地局間距離の場合、高トラフィック状態で送信電力の大きい移動局の送信電力を抑制することが可能となるので、他のセルへの干渉電力が軽減され、キャプチャー効果によりシステム性能の急激な劣化を回避することが可能となるという効果がある。

【図面の簡単な説明】

【図１】本発明の第１実施例のシステム装置構成を示すブロック図である。

【図２】目標受信電力値を求めるテーブルの一例を示す説明図である。

【図３】移動局の動作フローを示すフロー図である。

【図４】通常の送信電力制御における送信電力の変化を示すグラフである。

【図５】トラフィック量が大きな場合の送信電力変化を示すグラフである。

【図６】本発明の第２実施例における基地局構成を示すブロック図である。

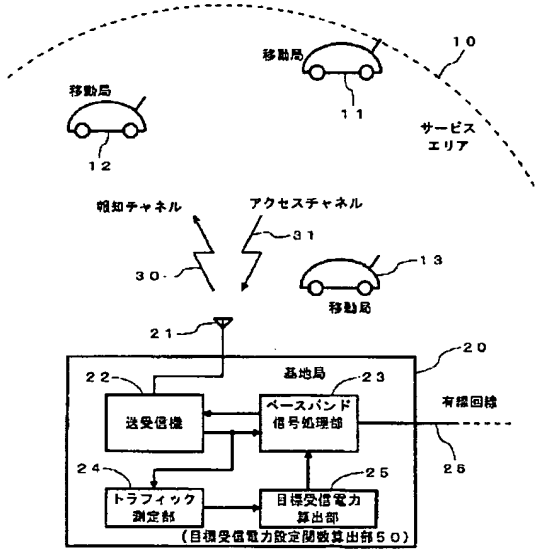
【図７】目標受信電力設定関数の一例を示す説明図である。

【図８】目標受信電力設定関数のパラメータ情報を求めるテーブルの一例を示す説明図である

【符号の説明】

１０…サービスエリア、１１、１２、１３…移動局、２０、４０…基地局、２１…アンテナ、２２…送受信機、２３…ベースバンド処理部、２４…トラフィック測定部、２５…目標受信電力算出部、２６…有線回線、３０…報知チャネル、３１…アクセスチャネル

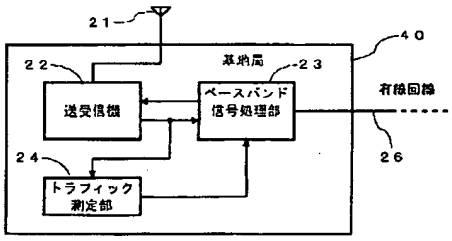
【図１】



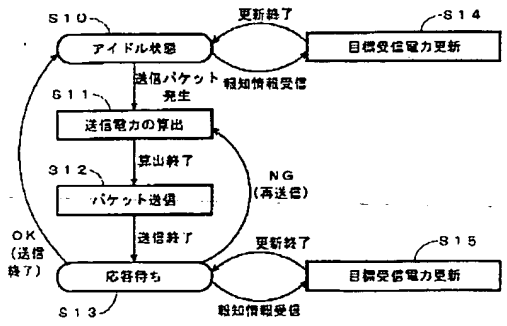
【図２】

測定トラフィック量	目標受信電力		
	属性１	属性２	属性３
～ ＴＨ１	POW11	POW12	POW13
ＴＨ１ ～ ＴＨ２	POW21	POW22	POW23
ＴＨ２ ～ ＴＨ３	POW31	POW32	POW33
ＴＨ３ ～ ＴＨ４	POW41	POW42	POW43
ＴＨ４ ～	POW51	POW52	POW53

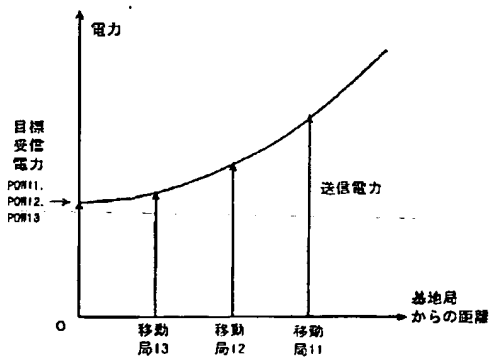
【図６】



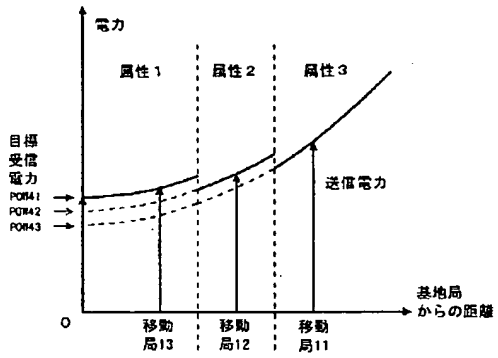
【図３】



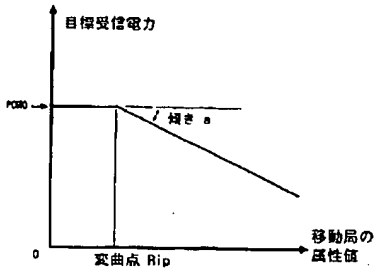
【図４】



【図5】



【図7】



【図8】

測定トラフィック量	パラメータ値	
	変曲点	傾き
～ TH1	Rip1	a1
TH1 ～ TH2	Rip2	a2
TH2 ～ TH3	Rip3	a3
TH3 ～ TH4	Rip4	a4
TH4 ～	Rip5	a5